भारतीय मानक
Indian Standard

IS 13429 (Part 2) : 2018

सौलर कुकर — बॉक्स टाइप — विशिष्टि

भाग 2 अवयव

(दूसरा पुनरीक्षण)

Solar Cooker — Box Type — Specification

Part 2 Components

(Second Revision)

ICS 27.160, 97.040.20

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August 2018 **Price Group 4**

Renewable Energy Sources Sectional Committee, MED 04

FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Renewable Energy Sources Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1992 and subsequently revised in 2000. While revising this standard based on the feedback received from various organizations connected with the solar cooking programme in the and certain other changes which would help in implementing the Indian Standard in a better way.

This standard is published in three parts. Other two parts of the standard are as follows:

IS 13429 (Part 1) : 2018	Solar cooker — Box type — Specifications: Part 1 Requirements
IS 13429 (Part 3) : 2018	Solar cooker — Box type — Specifications: Part 3 Test methods

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SOLAR COOKER — BOX TYPE — SPECIFICATION

PART 2 COMPONENTS

(Second Revision)

1 SCOPE

This standard (Part 2) specifies the requirements of various components of box type solar cooker.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY AND DEFINITIONS

For the purpose of this standard, the terminology and definitions given in IS/ISO 9488 shall be applicable.

4 COMPONENTS

4.1 Cooker Box

4.1.1 *Material*

4.1.1.1 The solar cooker box and top cover shall be made of any of or any combination of the following materials:

a) Aluminum alloy conforming to IS 737 or IS 733;
b) Fibre glass/Fibre reinforce plastic conforming to IS 10192;
c) Cold rolled carbon annealed (CRCA) steel sheet conforming to IS 513;
d) Galvanised steel (GS) sheets conforming to IS 277; and
e) Hot rolled carbon (HRC) steel sheet conforming to IS 1079; and
f) Any other material with life and strength similar to materials mentioned above suitable for long term (approximately 30 years) use in open environment with sun, rain and other atmospheric conditions.

4.1.1.2 The recommended minimum thickness of the materials shall be as given below:

Sl No.	*Material*	*Thickness* mm
i)	Aluminum	0.50
ii)	Fibre glass	3.00
iii)	Fiber reinforce plastic (FRP)	1.00
iv)	Galvanised/Stainless steel sheet	0.80
v)	CRCA/HRC	0.91

4.1.1.3 Any other material or combination of materials may be used with appropriate section thickness to achieve equivalent or better mechanical properties while meeting the overall mechanical load tests.

4.1.1.4 When the cooker box is made up of CRCA or HRC or any other material prone to corrosion while being exposed to atmospheric conditions prevailing, then suitable corrosion resistance coatings shall be provided on both sides (as per IS 1573 for electroplated parts).

4.1.1.5 The cooker box shall be smooth, even and free from sharp edges.

4.1.2 *Test*

4.1.2.1 *Performance test for cooker box*

The cooker box shall be opened and closed for one hundred times with evenly distributed load of 10 kg in the lid only and there shall not be any obstruction in this process. After opening and closing for one hundred times, the cooker box in further use shall open and close smoothly.

4.1.2.2 The locks and latches of cooker box shall be opened and closed for 1 500 times and after operating for 1 500 times, they shall not show any sign of malfunctioning.

4.1.2.3 *Impact test*

The cooker box shell shall not crackor show any damage or puncture when a spherical ball of 1.5 kg is allowed to fall from a height of one metre.

4.2 Handle and Knobs

4.2.1 The screws, studsnuts used for fitting handles and knobs shall be made from corrosion resistant material such as stainless steel or brass.

4.2.2 The rivets shall be made from corrosion resistant material, including aluminum.

4.2.3 The complete arrangement of a handle (or knob) and its fixing system as embodied in a finished, manufactureditem of solar cooker box mounted onto a rigid support such that the position and fixing conditions in an actual item of solar cooker box are exactly simulated.

The maximum temperature rise above ambient of a handle material or knob material to be contacted by the hand in normal use shall not exceed the following, as appropriate, when tested:

a) Plastics, wood, rubber: 50°C
b) Glass, porcelain,vitreous material: 40°C
c) Metal — Either 30°C, or where this is exceeded, the cookware shall carry a warning that in use the handle must be insulated, for example by the use of an oven glove.

NOTE — A handle, or part of a handle, affixed to a lid is regarded as a knob.

4.2.4 *Test*

4.2.4.1 *Creep test*

The handle of the cooker box shall be tested for tendency to come out of the fitting due to creep. For this, the cooker box shall be hung under static conditions for 200 h with a total mass of 30 kg. The handle shall not come out of its fittings.

4.2.4.2 *Fatigue test*

The cooker box with a total mass of 30 kg (inclusive of mass of the cooker) shall be allowed to vibrate minimum 2 000 times with an amplitude of 20 mm. The handle of the suitcase shall not fail in this test.

4.3 Cover Plate

4.3.1 *Material*

The cover plate shall be of double glazed with plane/tempered/toughened as per safety glass specifications according to IS 2553 (Part 1). Spacing between inner and outer glazings shall be 10 ± 2 mm.The solar transmittance of cover plate consisting inner and outer glazings together shall be minimum 65 percent at near normal incidence. The glazings shall be free from bubbles and rough surface and shall conform to the requirements given in **4.3.2**. Provision on the side shall be made to keep the cover plate at inclined position for loading and unloading of the cooking pots.

Any material including transparent polymer cover may be used provided it meets overall functional requirements of solar cooker.

4.3.2 *Test*

4.3.2.1 *Transmittance test*

4.3.2.2 Transmittance test is performed at the end of test sequence recommended in **4** of IS 13429 (Part 3).

4.3.2.3 The cover plate of the solar cooker shall be removed and mounted on (test frame) facing due south. The tilt of the cover plate shall be kept so as to facilitate measurement of solar radiation on the glass surface near normal incidence. In no case, the angle of incidence shall deviate more than 15° from the normal incidence.

4.3.2.4 The global solar radiation shall be measured using a pyranometer on the surface of glass cover for a period of 5 min in interval of 30 s and the values shall be integrated. Just after, similar measurements of the global solar radiation shall be made at the same inclination through the glass cover for a duration of next 5 min in interval of 30 s and the values shall be integrated. The ratio of the integrated values of the global solar radiation received through the glass cover and that received without glass cover shall be calculated. This ratio shall represent transmittance value for the cover plate.

4.3.2.5 This test shall be carried out on a clear sunny day and near solar noon so as to minimize effect of diffuse and reflected components of solar irradiance on the value of transmittance of the cover plate.

4.4 Cooking Tray

4.4.1 *Material*

4.4.1.1 The tray shall be of aluminium/copper having minimum thickness as 0.5 mm.

4.4.1.2 Any other material or combination of materials may be used with appropriate section thickness to achieve equivalent or better mechanical properties while meeting the overall mechanical tests.

4.4.2 *Test*

4.4.2.1 Inner surface of the cooking tray shall have mat black finish. It shall withstand temperature of 175°C for 1 h without deterioration of the finished surface. Later, the same surface be allowed to cool to room temperature and dipped in boiling water for 10 min and then shall conform to the requirement specified in **4.4.2.2** at room temperature.

4.4.2.2 Select 10 mm × 10 mm area of painted surface. Form squares of 1 mm × 1 mm by scratching horizontal and vertical lines by a pointed tool. Cover the test surface portion with adhesive cellulose tape (*see* IS 13262) properly, then remove the tape with jerk. Inspect the test surface, there shall be no peeling of paint.

4.5 Gaskets and Sealants

4.5.1 *Materials*

4.5.1.1 Gaskets used minimum 2 mm thickness for sealing the glass with cooker box, the closed lid and tray Channel section or making shock proof may be of neoprene /silicon / EPDM rubber channel section.

4.5.1.2 Grommets minimum 2 mm thickness for sealing the cookerbox,the closed lid tray and other joint may be one of the following types and shall fit properly so that no dust can pass through the joints:

a) Neoprene rubber;
b) EPDM;
c) Silicon rubber; and
d) *In-situ* formation of any of the above material.

4.5.2 *Test*

4.5.2.1 Grommets and gaskets shall conform to the thermal shock test given in **4.5.2.2**.

4.5.2.2 *Thermal shock test for gasket and sealants*

Keep the gasket and sealant of 10 cm in length in an electric oven at a temperature of 150°C for 4 h and then cool in air for 2 h. Put it again in the oven at 150°C for 4 h and then cool in air for 2 h. After the test, the gasket and sealant shall show no crack/ brittleness.

4.6 Insulation

Insulation shallbe provided at sides and bottom including edges. Thermal resistance (R) of insulation material shall be minimum 0.96 m^2°C/W. This shall be derived after determining thermal conductivity (k) value at 100°C mean temperature in accordance with IS 3346.

4.6.1 The thermal resistance value (R) of insulation for non-metallic body cookers shall be 0.58 m^2°C/W minimum provided the cooker meets the requirements of thermal performance test specified in IS 13429 (Part 1).

NOTE — Thermal resistance (R) value shall be derived by the equation $R = L/K$ where L = thickness of insulation material and K is thermal conductivity. Thermal conductivity shall be determined at 100°C mean temperature in accordance with IS 3346.

4.7 Mirror or Reflector (Metallic)

Mirrors or reflector shall be free from bubbles and waviness having minimum 65 percent (Mirror) and minimum 80 percent (Reflector) solar reflectance.The reflecting area of mirrors shall not be less than the glazing area. Provision on the sides shall be made to keep the mirror in any inclined position.

The reflecting surface shall be subjected to reflectance test in accordance with **5.3** of IS 13429 (Part 3).

4.8 Cooking Pots with Lid

4.8.1 The solar cooker shall be supplied with the aluminium alloy (*see* IS 21)/stainless steel (*see* IS 15960) pots with suitable lids.

4.8.2 Solar cooker cooking pots shall be coated with mat black surface on outside which shall conform to the test given in **4.4.2**. The bottom ofthe pots shall not be coated.

4.9 Caster Wheels

Solar cooker may be provided with 4 caster wheels each having ball bearing (*see* IS 5932) or two cylindrical plastic or non-corrosive supports (buffers) for front and two plastic or non-corrosive wheels for rear.

4.9.1 *Test*

4.9.1.1 Caster wheels shall confirm to the test given in **4.9.1.2**.

4.9.1.2 A cooker box with castor wheels with total mass of 30 kg shall be allowed to move on castor wheel over a distance of 2 km. At the end of the test, the wheels, the wheel mounting arrangement and the pulling device shall not show visible wear and tear and shall function as smoothly as before the test.

4.10 Workmanship and Finish

All the surfaces shall be smooth and free from roughness, raised spots, scale or any other surface defects. Sharp edges and corners shall be rounded off.

The screws, hinges, lever rods, locks, handle, caster wheels, etc, used in the cooker shall be properly fitted.The weight of various components of cooker shall also be set in such a way that it does not topple back while lifting the cover plate for loading and unloading of cooking pots.

4.11 Assembly and Workmanship

4.11.1 The entire assembly shall be free from surface defects. All sharp edges and corners shall be rounded off. The exposed surfaces shall be properly made corrosion resistant.

4.11.2 The insulation shall be provided in such a way that no slippage occurs when cooker is kept at any angle of its position.

4.11.3 The cover plate shall be fixed with the cooker box through gasket which could provide an effective seal against water and dust between the collector box and cover, also to protect the cover plate from damage during its thermal expansion.

4.11.4 The cooker shall be so assembled, that replaceable components are accessible for repair or replacement at site in accordance with the manufacturer's instructions.

4.12 Durability, Reliability and Safety

The durability, reliability and safety of cooker depends correct choice of materials and appropriate manufacturing processes. Following general points needs to be considered during selection of materials, overall design of cooker and selection of manufacturing processes:

a) Non-combustible material should be preferred as the cooker may be affected by airborne fire or radiant heat.
b) Adequate protection against rain water entry should be taken care.
c) Since the cookers are exposed to seasonal variations, thermal shocks and thermal cycles on daily basis, the selected externally exposed materials to have adequate UV resistance.
d) Other components should have thermal stability even at maximum stagnation temperature.
e) Mechanical joints and overall design should have adequate strength to take wind load, snow load and other environmental stresses. The joints and other components should not leak due to thermal expansion during cooking.
f) Cooker insulation material to be CFC free.
g) Non-recyclable material to be avoided or the usage to be minimized to the possible extent.
h) Environmental friendly manufacturing processes and testing to be followed covering both component and finished goods.

4.13 Marking

4.13.1 Each component may be marked or a label affixed with the manufacturer's name, initials or recognized trade-mark.

4.13.2 *BIS Standard Mark*

The solar cooker components may also be marked with the Standard Mark.

4.13.2.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder.The details of conditions under which a licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
21 : 1992	Wrought aluminium and aluminium alloys for manufacture of utensils — Specifications (*fourth revision*)
277 : 2003	Galvanized steel sheet (plain and corrugated) (*sixth revision*)
513 : 2008	Cold reduced low carbon steel sheet and strip
733 : 1983	Wrought aluminium and aluminium alloy bars, rods and sections (for general engineering purposes) (*third revision*)
737 : 2008	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes — Specifications (*fourth revision*)
1079 : 2017	Hot rolled carbon steel sheet, plate and strip — Specification (*seventh revision*)
1573 : 1986	Specification for electroplated coatings of zinc on iron and steel (*second revision*)
2553 (Part 1) : 1990	Safety glass — Specification: Part 1 General purpose (*third revision*)
3346 : 1980	Method of the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method) (*first revision*)
5932 : 1970	Boundary dimensions for thrust ball bearings with flat seats
10192 : 1982	Specification for synthetic resin bonded glass fibre (SRBGF) sheets for electrical purposes
13262 : 1992	Pressure sensitive adhesive tapes with plastic base — Specification
13429	Solar cooker — Box type — Specification:
(Part 1) : 2018	Requirements (*second revision*)
(Part 3) : 2018	Test methods (*second revision*)
15960 : 2013	Composite bottom stainless steel cooking utensils — Specification
IS/ISO 9488 : 1999	Solar energy — Vocabulary

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Renewable Energy Sources Sectional Committee, MED 04

Organization	*Representative(s)*
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Biogas Forum India, New Delhi	Dr A. R. Shukla
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